CIP SLIDE TRAINING SERIES

STEM CUTTINGS, a Rapid Multiplication Technique for Potatoes

Series I: Rapid Multiplication Techniques,

Guide-Book 1/3

INTERNATIONAL POTATO CENTER (CIP)
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INTERNATIONAL POTATO CENTER (CIP)

DEPARTMENT OF TRAINING AND COMMUNICATIONS

Series I: Rapid Multiplication Techniques

This CIP Slide Training Series was produced by the Department of Training and Communications of the International Potato Center to guide training of those who are or will be involved in the implementation of rapid multiplication techniques for potatoes in developing countries.

The objective of CIP Series I is that each participant describe the steps involved in four rapid multiplication techniques for potatoes presently developed. The techniques are:

- Sprout Cuttings (Set 1)
- Single-Node Cuttings (Set 2)
- Stem Cuttings (Set 3)
- Leaf-Bud Cuttings (Set 4)

The CIP slide training sets are designed to be used in instructor-directed training. They may also be used for individualized learning, in which learners may study directly from the guide-book aided by the slides, or for on-site recall. In all cases, complementary practice activities are essential for effective skill development.

STEM CUTTINGS, a Rapid Multiplication Technique for Potatoes

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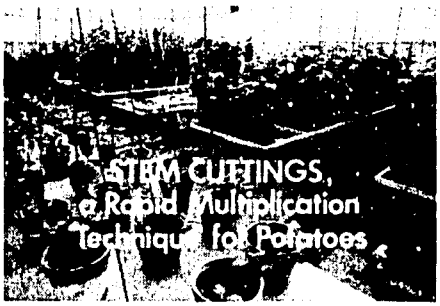
1



Introduction.

Stem cuttings used as a rapid multiplication technique can produce 20 to 60 cuttings from each mother plant. The use of stem cuttings breaks contact with tuber- and soil-borne non-systemic diseases and nematodes, effectively eliminating diseases caused by pathogens such as *Erwinia* spp., *Rhizoctonia solani,* and *Synchytrium endobioticum* (wart).

2

Remove apical growing points from young, rapidly growing plants. This stimulates growth from axillary buds at each leaf. These are removed when 12 to 15 cm long and rooted in coarse, sharp sand. The rooted cuttings are then transplanted to the field. Each cutting yields from 400 to 1000 g of tubers when properly grown under field conditions. Transplanting in infected soil results in reinfection. Each variety may react differently. Experiment to determine reactions under your conditions prior to embarking on a full scale program.

3

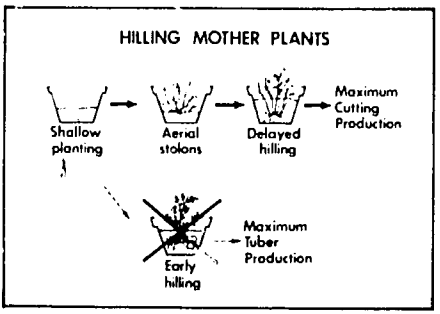
Procedure.

Use the best available tuber to produce the initial mother plant. They need not be virus-free, but only free of those systemic diseases important to the seed program. They should be well-sprouted to give a maximum number of stems. Green sprouts give fast emergence. Mother plants can also originate from cuttings of any type.

4

When producing stem cuttings, the objective is to harvest portions of the potato vine. Note the difference in potential cuttings from one, two and three stemmed plants. For maximum use of plant house space, plants with 3 or 4 stems are desirable, depending on pot size and variety. The potting mix should be adequately fertilized.

5



Plant tubers deep in well-drained pots with a shallow covering of potting mix. Hilling after stolons become aerial maximizes top growth. When only tuber production is needed, the hilling should occur earlier.

6

Plants showing the difference between a delayed hilling (left) and an early hilling (right). The aerial stolons are harvested as cuttings.

7

Follow strict sanitary procedures to prevent spread of contact viruses and other diseases. Before working with each plant:

a) wash hands and knives in a strong soap solution or other approved chemicals that have a high pH;
b) use other chemicals or methods depending on potential disease problems; and
c) wear clean clothes that have not been in contact with other plants.

8

Mother plants 25-30 cm tall, ready to remove the apical growing point of each stem. This removal stimulates growth of lateral shoots from the axillary buds at each leaf.

9

The apical growing point being removed. It must be completly taken out. Excessive removal of nodes will reduce the number of future stem cuttings. Removal can be by tweezers as shown or by cutting.

10

Cuttings ready to harvest. They are usually ready 15 to 20 days after removal of the apical growing point. Additional harvests are made at 12 to 15 day intervals. On this plant, the second harvest is ready.

11

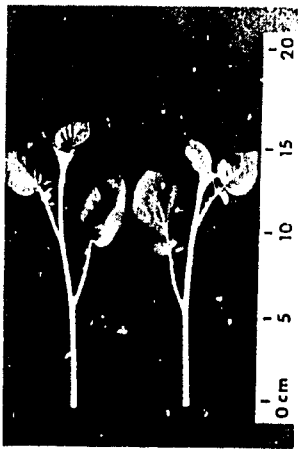
Excising the cuttings.

- Cut at a right angle and make one smooth cut.
- Cut against a support such as this disinfected paper towel. Do not cut your finger.

12

Cut close to the new axillary bud(s), taking care not to damage the bud. This bud produces the next stem cutting.

13



Stem cuttings should be 12 to 15 cm long. When possible, leave a 4 to 5 cm stem below the first node. If low humidity is a problem, several lower leaves can be removed. Do not damage the nodes.

14

Cuttings must be protected until placed in the rooting sand. If there is a delay, cover them with a moist paper towel to prevent wilting and place in the shade. Cuttings can be held up to two days if placed in a cool refrigerator at 4° to 6°C.

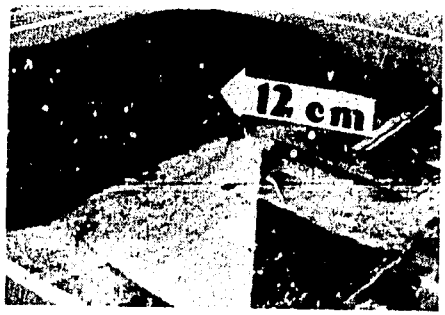
15

The mother plant must be properly fertilized for maximum production of cuttings. Nitrogen promotes young, rapidly growing plants and cuttings. Phosphorous is needed for fast root development. Apply extra liquid fertilizer after removal of the growing point and after each harvest of stem cuttings. Dissolve 5 grams of 12-14-12 or similar fertilizer in one liter of water. Application of 150 cm^3 per plant has worked well on medium sized plants in pots 20 cm high.

16

The second and subsequent harvests of cuttings yield 30 to 60% more than the first. This is because of new vine growth as well as double node development as shown here.

17



The rooting substrate must be well drained. The rooting table can be tilted or have a fine screen bottom. Best results occur when a 5 cm layer of course gravel covers the bottom, with 10 to 12 cm of the finer rooting substrate on the top. The screen shown here separates the gravel from the sand.

18

A rooting substrate of sharp, washed sand, 1 to 2 mm grain-size, consistantly gives the best results. It is moistened and compacted prior to planting to prevent cave-in of the planting holes. Sand coarser than 2 mm provides little contact with roots. A fine sand retains too much water which eliminates oxygen, thus inhibiting root formation.

19

Holes for the cuttings are made on 5 cm squares, about 4 cm deep. Planting closer results in entangled roots. A less dense planting is poor use of space.

20

When needed, cuttings are dipped in a rooting hormone. Length of time in the hormone depends on the variety and hormone used. Use of hormones may speed up rooting by 2 to 3 days. Its use is not always recommended.

21

Place the cuttings in the holes. Keep leaf nodes above the sand surface during rooting.

22

Adequate lateral and vertical pressure is applied to assure good contact of cutting and sand. To assure contact, pull very gently on the cutting. If it is loose, it does not have proper contact.

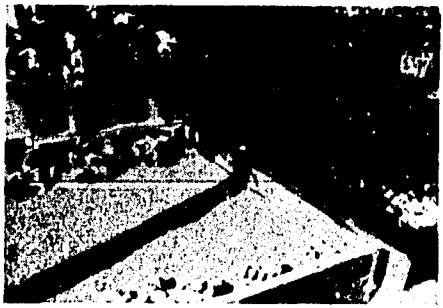
23

After planting, apply a light irrigation. Do not wash the sand away from the cuttings. If hormones were used, wait at least 2 hours before irrigating to allow the hormone to soak in. Other irrigations should be light and frequent depending on evaporation and temperature.

24

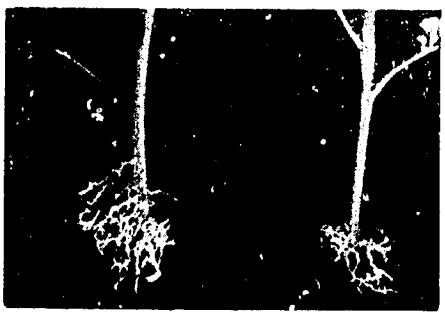
Shade may be necessary to prevent evapotranspiration and wilting. The method should be simple and cheap. The white color reflects heat.

25



Note the wilting of the cuttings in the sun (left) and the turgid cuttings in the shade (right). Never permit cuttings to come under stress during the rooting process.

26

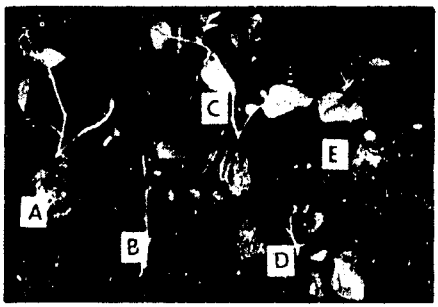


Reduced rooting time is not the only effect of the hormones. The number and location of the roots is also affected. No hormone (right) shows few roots, coming mostly from the base of the cutting. With hormone (left) shows more roots coming from all parts of the cutting. If some roots are broken during lifting and transplanting there is less effect on the treated cutting.

27

A rooted cutting 14 days after removal from the mother plant. It is ready for transplanting. Do not remove the sand adhering to the roots and never allow the roots to dry out. For best transplanting results the size and amount of roots should never exceed these.

28



At the time of transplanting, eliminate any stem cuttings not properly rooted. If many cuttings are not useable, determine why and prevent the losses.

A. Well rooted cutting.

B. Few roots. Caused by poor contact with the sand or lack of moisture during rooting.

C. Cutting well rooted, but very mature. It will tuberize very early and produce few tubers. Avoid rooting this type of cutting.

D. Stem rotting. Caused by damping-off pathogens resulting from excess sand moisture and poor drainage. Use recommended fungicides as a preventative. Improve the drainage.

E. Tuber formed. Cutting came from a physiologically old mother plant and/or the first leaf node was below the sand. Check fertility rate on mother plant. Grow mother plant during longer day length. Keep nodes above the sand surface during rooting.

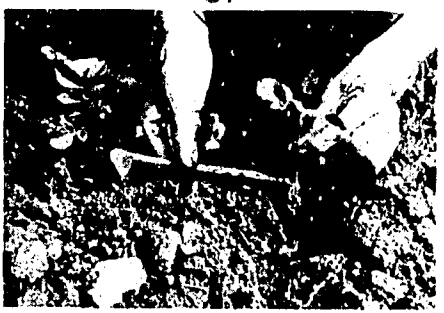
29

Rooted cuttings can be transplanted to pots to produce new mother plants or for tuber production. Number of stems can be controlled. Plant deep in the pot as with tubers. Cover one or more leaf nodes with soil.

30

Cuttings prepared for long distance transport to the field. Note the sand rooting substrate in the glasses. Under cool conditions, cuttings can be held 4 to 5 days if properly watered and if they have sufficient light. The glasses have drainage holes in the bottom.

31



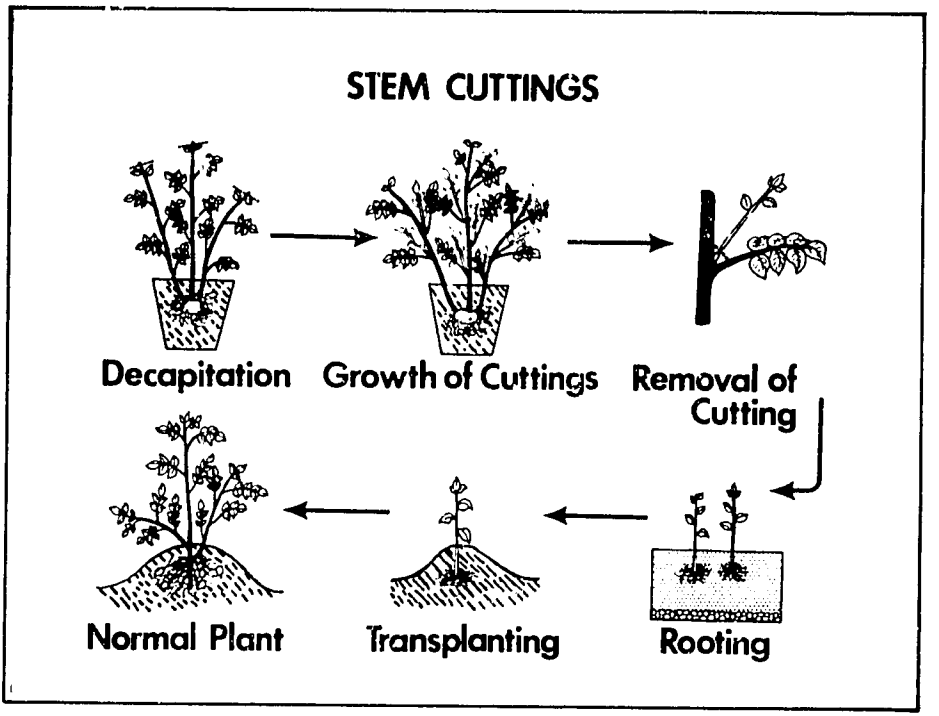
When transplanting to the field, place the plants a uniform distance apart with one or more leaf nodes below the soil. Never allow the roots to come in contact with dry fertilizer. Water the cuttings to assure good root-soil contact. Add to the water a water soluble fertilizer with a high phosphorus content to give early and rapid root development.

32

In the field, cuttings need 1 to 2 early and light hillings to place stolon-forming nodes below the soil surface. The final hilling should be done as for plants produced from tubers.

33

Normal yields of 1/2 to 1 kg can be expected. Some tuber deformation seems to be normal. These tubers, when replanted, yield tubers without the deformation.



Summary.

a) Each stem of the mother plant is decapitated;
b) stem cuttings form at the leaf nodes;
c) cuttings are carefully removed;
d) cuttings are rooted;
e) cuttings are transplanted to field or plant house; and
f) they produce normal plants.

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